

REMARKS

In response to the Office Action mailed September 6, 2005, the Applicants respectfully request reconsideration. To further the prosecution of this Application, the Applicants submit the following remarks, has canceled claims and has added new claims. The claims as now presented are believed to be in allowable condition.

Claims 13-16 were pending in this Application. By this Amendment, claims 1-12 are cancelled without prejudice. The Applicants reserve the right to prosecute these claims in one or more continuation applications. Additionally, claim 14 has been cancelled, claim 13 has been amended to include the features of claim 14, and claims 17-28 have been added. Accordingly, claims 13 and 15-28 are now pending in this Application. Claims 13, 21, and 28 are independent claims and the remaining claims are dependent claims.

No new matter has been added to the Application as a result of the amendments and the Applicants have not raised any new issues that would require further searching and consideration.

Rejections under §102 and §103

Claim 13 was rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,627,822 to Jackson. Claims 14 and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of U.S. Patent No. 6,736,306 to Byun. Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of U.S. Patent No. 6,600,220 to Barber.

Applicant respectfully traverses each of these rejections and requests reconsideration. The claims are in allowable condition.

As noted above, claim 13 has been amended to include the features of cancelled claim 14. As a result, the rejection of claim 14 under 35 U.S.C. §103(a) as being unpatentable over Jackson in view Barber is addressed below.

As amended, claim 13 relates to a method for manufacturing an area array package. The method includes coupling a grid array of primary electrical contacts to a coupling surface of a substrate within a central portion defined by the substrate where the grid array of primary electrical contacts is configured to carry at least data signals between the area array package and a circuit board. The primary electrical contacts of the grid array are formed as a plurality of primary solder balls where each primary solder ball of the grid array defines a first diameter. The method further includes coupling a series of secondary electrical contacts to the coupling surface of the substrate within a peripheral area defined by the coupling surface where the series of secondary electrical contacts is configured to carry power signals between the area array package and the circuit board with the series of secondary electrical contacts being separate from the grid array. The series of secondary electrical contacts are formed as a plurality of secondary solder balls where each secondary solder ball of the series defines a second diameter and where the second diameter defined by each of the secondary solder balls is greater than the first diameter defined by each of the primary solder balls.

Jackson generally relates to an electronic assembly with separate power and signal connectors. In particular, the electronic assembly in Jackson includes a substrate, such as a semiconductor chip or a socket to hold a semiconductor chip, having a multiplicity of solder balls. Each solder ball can be melted to form a signal connection with corresponding conductive pads of a printed circuit board. The electronic assembly also includes a plurality of pins that electrically connect with holes formed in the printed circuit board to form power connections between the substrate and the circuit board.

Byun generally relates to a semiconductor chip package configured to prevent cracks from forming between external connection terminals, such as solder balls and ball pads. In Byun, a board-mounted BGA package 200 includes a chip 110 mounted on a substrate 120 and enhanced pads 170 formed at the outer edges of the bottom surface of the substrate 120. Each of the enhanced pads 170 includes a ball pad 124, at least one dummy pad 174, and a dummy pattern 172 that connects the ball pad 124 to the dummy pad 174. In Byun, when mounting the BGA package to a board 150 using the enhanced pads 170, solder balls 160 are formed on both the ball pads 124 and the dummy pads 174 of the substrate 120. The solder balls 160 then undergo a solder reflow process to form a connection terminal 162 over an entire area of the enhanced pad. Regarding the connection terminal, Byun recites that:

[s]ince a single connection terminal is formed using the whole area of the enhanced pad (including the ball pad, the dummy pads, and the dummy patterns), this preferred method of the present invention effectively improves the reliability of the solder joint. Moreover, in this embodiment, most of the dummy patterns are arranged parallel to the long side of the substrate, along which cracks mainly occur, thereby more effectively preventing cracks. Thus, the foregoing embodiments of the present invention improve the reliability of the package mounting. Column 5, lines 23-32.

Claim 14, as amended, is patentable over Jackson in view Byun because there is no suggestion in the references to modify or combine the reference teachings to form the Applicants' invention as claimed. As indicated above, Jackson includes *solder balls* that form signal connections with a printed circuit board and *pins* that form power connections with the circuit board. Byun discloses reflowing solder balls at the outer edges of a substrate to form connection terminals 162 to "improve the reliability of the solder joint" between the substrate and the circuit board. There is no suggestion in either Jackson or Byun to form "secondary electrical contacts configured to carry power signals between the area array package and the circuit board" (e.g., Jackson's pins) as

“a plurality of secondary solder balls, each secondary solder ball of the series defining a second diameter, the second diameter defined by each of the secondary solder balls being greater than the first diameter defined by each of the primary solder balls” as claimed by the Applicant. A combination of Jackson and Byun would result in a device similar to that shown in Jackson's FIG. 1D where the solder balls located in proximity to the pins are formed as the connection terminals in Byun such that the solder balls extend over multiple pads. With such a combination, the enhanced solder balls in Jackson would improve the reliability of the solder joint and effectively prevent cracks from forming.

Because neither Jackson nor Byun teach or disclose each element of the Applicants' claim 13 as amended, claim 13 is patentable over Jackson in view of Byun and should be allowed to issue. Additionally, claim 15 which depends from claim 13, should also be allowed for at least the reasons presented above.

As indicated above, claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over Jackson in view of Barber. Claim 16, however, depends from allowable independent claim 13 and should be allowed to issue in light of the rejection.

#### Newly Added Claims

Claims 17-28 have been added and are believed to be in allowable condition. Support for claims 17 and 23 is provided within the Specification, for example, on page 13, lines 6-12. Support for claim 18 is provided within the Specification, for example, on page 13, line 26 through page 14, line 12. Support for claim 19 is provided within the Specification, for example, on page 9, lines 6-16. Support for claims 20 and 24 is provided within the Specification, for example, on page 11, lines 2-4. Support for claim 21 and 28 is provided within

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the Specification, for example, on page 9, lines 6-16. Support for claims 26 and 27 is provided within the Specification, for example, on page 13, lines 13-20. No new matter has been added.

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Conclusion

In view of the foregoing remarks, this Application should be in condition for allowance. A Notice to this affect is respectfully requested. If the Examiner believes, after this Response, that the Application is not in condition for allowance, the Examiner is respectfully requested to call the Applicant's Representative at the number below.

Applicant hereby petitions for any extension of time which is required to maintain the pendency of this case. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3661.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-2900, in Westborough, Massachusetts.

Respectfully submitted,



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